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NEW UTILITY PATENT APPLICATION TRANSMITTAL

(only for new nonprovisional applications under 37 CFR 1.53(b))

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APPLICATION ELEMENTS

1. ☒ Fee Transmittal Form
   ☒ Check Enclosed ($40.00)
2. ☒ Specification
   (preferred arrangement set forth below)
   ■ Descriptive Title of the Invention
   ■ Cross Reference(s) to Related Case(s)
   ■ Statement Regarding Fed sponsored R & D
   ■ Background of the Invention
   ■ Brief Summary of the Invention
   ■ Brief Description of the Drawing(s)
   ■ Detailed Description
   ■ Claim or Claims
   ■ Abstract of the Disclosure
3. ☒ Drawing(s) *(when necessary per 35 USC 113)*
4. Oath or Declaration
   a. ☒ New Declaration
   ☒ Executed
   b. ☐ Copy from a prior application (37 CFR 1.63(d))
   (for continuation/divisional with Box 17 completed)
   i. ☐ DELETION OF INVENTOR(S)
   Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
5. ☐ Incorporation by Reference *(useable if Box 4b is checked)*. The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

ACCOMPANYING APPLICATION PARTS

6. ☒ Assignment & Assignment Recordation Cover Sheet
7. ☐ Certified Copy of Priority Document(s)
   (if foreign priority is claimed)
8. ☐ Information Disclosure Statement & PTO-1449
   ☐ Copies of IDS Citation(s)
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10. Small Entity Statement
    ☐ New Statement enclosed
    ☐ Statement filed in prior application. Status still proper and desired
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17. **If a CONTINUING APPLICATION,** *check appropriate box and supply the requisite information below and in a preliminary amendment:*
☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No: ___/_______
Prior application information: *Examiner:* ______________ *Group/Art Unit:* ____________

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RECONCILING COMBINATIONS OF TRANSACTIONS

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RECONCILING COMBINATIONS OF TRANSACTIONS

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BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to financial and investment software, and more particularly to a system, method, and computer program product for automated reconciliation between two differently recorded sets of transaction records.

2. Description of Background Art

Software for managing personal and/or business finances and investments typically provides functionality for reconciling a user-maintained transaction register with a statement provided by a bank or other financial institution. In conventional financial software applications, a reconcile function operates as follows. Upon receiving a statement from the financial institution, the user activates the reconcile function or mode, and specifies a closing date and ending balance for the statement. All transactions in the register are displayed, except those that have previously been cleared against prior statements. Transactions occurring after the closing date may be omitted or displayed differently from other transactions. The user is then given an opportunity to clear individual transactions in the register by matching them against transactions in the statement. Once the user has cleared all the transactions from the statement, software 307 compares the statement ending balance, adjusted for uncleared transactions, against the register ending balance. If necessary, and if requested by the user, an adjustment is made to the register. The reconciliation is then complete.

The above-described process entails substantial manual effort by the user. The user must manually review each transaction in the statement and check it against the list of register transactions. This process may be time-consuming and error-prone.

Accordingly, many financial software applications provide an automated reconciliation function, wherein the statement from the financial institution is retrieved (such as from an online source) and downloaded onto the user's computer. Software 307 then automatically compares the retrieved statement with the user-entered register. Software 307 attempts to match downloaded statement transactions with register transactions, by comparing the dates and amounts of the transactions, as well as payee or other descriptive information. Some software applications perform a "fuzzy" match determination, in order to allow for slight differences in dates, amounts, and other descriptive information. For example, such software applications may be able to detect a match between a $36.50 register transaction dated June 24th and a $36.60 statement transaction dated June 26th (thus accounting for bank processing time, inaccuracies in entry of data, and the like). In general, such software applications attempt to mimic the type of judgment call a human would make in performing manual reconciliation. In such software applications, the user may be queried as to whether to match a particular statement transaction against one of a limited group of register transactions (or vice versa), particularly when the "fuzzy" match determination algorithm fails to provide a definitive result.

In general, such prior art systems attempt to take into account discrepancies between user-entered transactions and corresponding bank-entered transactions. However, there are many circumstances in which these systems are not capable of identifying matches, despite the "fuzzy" match capability. In particular, in many situations the bank may combine several transactions that the user has entered separately. Conversely, the user-entered register may contain a combined transaction record reflecting several transactions that the bank has entered separately. Since in such situations the amounts for the transactions differ substantially between the user-entered register and the bank statement, the automated reconciliation function is not able to detect a match.

For example, a user may enter into the software two transactions on a particular date, representing a $457 deposit and a $213 deposit. In the bank's records, these transactions may be recorded as a single transaction in the amount of $670; this may occur, for example, if the user presented the items together when making the deposit at the bank. The above-described automated reconciliation function would fail to detect a match, since no single transaction in the register matches a transaction in the statement. This is undesirable, since the user would then have to manually indicate that these transactions should be cleared.

As another example, in an investment account, a register may record transactions representing user contributions, and may further record separate transactions representing an employer's matching contributions. The financial institution may record the user contribution and the employer contribution together, as a single transaction. Again, the above-described automated reconciliation function would fail to detect a match, since the financial institution's single transaction would not match any single transaction in the register.

What is needed, then, is a system, method, and computer program product for detecting matches between two lists of transactions, where one of the transaction lists contains a combined transaction representing two or more transactions in the other transaction list. What is further needed is an automated reconciliation system, method, and computer program product that is capable of recognizing matches between a combined transaction and separately recorded transactions. What is further needed is an automated reconciliation system, method, and computer program product that is capable of recognizing matches between different combinations of transactions.

SUMMARY OF THE INVENTION

The present invention reconciles transactions in transaction lists, and is able to detect combined transactions in one transaction list and match them appropriately with separately recorded transactions in another transaction list. The invention thus facilitates automated reconciliation between a user-maintained register and a downloaded statement from a financial institution, even when the register and the statement each combine transactions in different ways. The present invention is applicable to any software application or system having an automated reconciliation function, including for example personal finance software for tracking bank accounts and/or investment accounts.

The present invention further detects a match between a value in one list and a combination of values in a second list. The invention is thus applicable to other domains, systems, and environments in addition to automated reconciliation applications.

The invention determines whether, for two lists of values, a single value in the first list matches a combination (such as a sum) of values in the second list. In addition, the invention is able to perform many-to-many transaction matching, in which a combination of values in the first list matches a different combination of values in the second list.

In one embodiment, the invention employs a recursive function, which calls itself in order to successively eliminate individual values from the second list available for matching, until a matching combination is found, or until all possibilities are exhausted. Values may correspond, for example, to transaction amounts for a reconciliation application.

The present invention may be implemented together with a "fuzzy" transaction-matching scheme that detects matching transactions even when particulars of the transactions are not identical, such as for example transactions having slightly different dates or amounts.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a flowchart of a method for matching transactions according to the present invention.

Fig. 2 is a flowchart of a recursive function.

Figs. 3A and 3B are block diagrams of one system architecture for practicing the present invention.

Fig. 4 is an example of a reconciliation operation.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to Figs. 3A and 3B, there are shown block diagrams depicting a system architecture for practicing the present invention.

In one embodiment, user's computer 304 runs software application 307 for entering and storing information describing various transactions. Examples of such a software application 307 include a personal finance software application, an accounting system, or an investment tracking application. Software application 307 is stored in memory (not shown), such as random-access memory (RAM), and executed by a processor (not shown) such as an Intel Pentium processor. Transaction information is stored on user's computer 304 in a transaction register 305, which may be stored, for example, on a hard drive or other medium. Transaction register 305 typically contains a number of transaction records that have been entered by the user, such as for example records of checks that have been written, deposits made, and the like.

In an alternative embodiment (not shown), software 307 for entering and storing the transactions may be provided at a remote server, such as bank server 301, with which the user's computer 304 communicates over a network such as the Internet. In such a server-based software application implementation, transaction register 305 may be stored at the remote server rather than on user's computer 304. The user may interact with the server-based software application using a browser or other means for communicating over the network. Alternatively, user-entered transactions may be temporarily stored on user's computer 304 and periodically uploaded to the remote server. Such server-based software and storage may be advantageous, for example, when the user may wish to access transaction register 305 from different computers at different times.

Periodically, the user may wish to reconcile transaction register 305, containing user-entered transactions, with a statement or listing of stored transactions 302. Such reconciliation is useful, for example, to determine whether a deposit was properly credited, or a check cashed by its payee. In an automated reconciliation scheme, user's computer 304 contacts a bank server 301 and downloads a subset of stored transactions 302 (constituting a downloadable bank statement) from server 301. Bank server 301 may be a remote computer, for example, containing records of transactions associated with many different customers. In alternative environments, server 301 may be associated with an investment firm or other financial institution. Stored transactions 302 represent those particular transactions associated with the user performing the reconciliation. The mechanisms and protocols for downloading transaction data are well known in the art (such as, for example, the Open Financial Exchange (OFX) protocol).

Software 307 then compares downloaded transactions 306 against user-entered transactions in register 305. Matching transactions are so indicated. Matches are detected by comparing, for example, amounts, reference numbers, dates, payee information, or any combination thereof. "Fuzzy" matching, taking into account slight discrepancies between the two sources of transaction information, may be employed. In some situations, register 305 may contain two or more transactions which, when combined, correspond to a single transaction in downloaded transactions 306. In other situations, the converse may be true, so that downloaded transactions 306 may contain two or more transactions which, when combined, correspond to a single transaction in register 305. As described in more detail below, the present invention detects such matches where transactions that may appear separately in one list are combined in the other.

One skilled in the art will recognize that the system architecture illustrated in Figs. 3A and 3B is merely exemplary, and that the invention may be practiced and implemented using many other architectures and environments. For example, the present invention may be employed to match values between any two lists of transactions or other records, whether stored in the same location, entered by a user, or transmitted across a network.

Referring now to Fig. 4, there is shown an example of a reconciliation operation according to the present invention. Downloaded transactions 306 are reconciled against user-entered transaction register 305. If desired, transactions 306 may be limited to a particular subset of all recorded transactions, based on a date range. The particular fields shown in Fig. 4 for each recorded transaction include date, reference number, payee/description, and amount; other fields may be provided, such as category, comments, and the like. As can be seen from the example of Fig. 4, some transactions are reconciled by matching a combination of the stored fields. For example, transactions 306 include a Nov. 1 payment to Safeway, having a reference number of 2131 and an amount of $112.23. A transaction in register 305 has the same date, payee, reference number, and amount; therefore software 307 considers this transaction to be a match, and automatically reconciles it. Other methods and techniques for matching single transactions may also be applied, as will be apparent to one skilled in the art.

In some cases, some of the fields may have different information, or may be missing information entirely. Software 307 employs "fuzzy" matching by allowing for certain tolerances in the values stored in the various fields of the transaction records. For example, the Nov. 11 transaction having reference number 2135 and an amount of $25.00 (as recorded in transactions 306) is reconciled with a transaction in register 305 having a slightly different date of Nov. 10 and a slightly different amount of $24.00. Since the reference numbers correspond with one another, and since the difference in date and amount are relatively slight, the match is likely correct. The degree to which such variations are tolerated, and the interaction between different fields, may be predefined or user-adjustable. In particular, dates recorded in the user-entered transaction register 305 may not necessarily correspond with dates recorded in transactions 306, due to bank processing time; thus software 307 allows for a variation in the dates of recorded transactions. One skilled in the art will recognize that other similar techniques may also be employed.

In some cases, a downloaded transaction in 306 does not correspond to a single transaction in register 305, but does correspond to a combination of transactions in register 305. This may occur, for example, if the user enters two or more transactions separately, while the bank or financial institution's records show a single combined transaction representing the same activity as the two or more transactions entered by the user. For example, in Fig. 4 the three deposits indicated in register 305 as occurring on Nov. 1 were recorded separately by the user, but were combined into a single transaction (dated Nov. 3) in the bank's records 306. Accordingly, when software 307 fails to detect a match for a particular transaction in transactions 306, it searches for a combination of transactions in register 305 that matches the transaction in 306, in accordance with the methods of the present invention.

Conversely, a single transaction in register 305 may not correspond to a single transaction in 306, but may correspond to a combination of transactions in 306. This may occur, for example, if the user enters a combined transaction while the bank or financial institution's records show two or more distinct transactions representing the same activity as the single user-entered transaction. For example, in Fig. 4 the two checks dated Nov. 7 and Nov. 9 in transactions 305 were recorded separately by the bank, but were combined into a single transaction (dated Nov. 6) in the user-entered register 305. Accordingly, in one embodiment, the present invention may also search for a combination of transactions in 306 that matches a single transaction in register 305.

Referring now to Fig. 1, there is shown a flowchart of a method of matching such transactions according to one embodiment of the present invention. In one embodiment, the steps of Fig. 1 are performed by user's computer 304 or by a server computer, in accordance with stored instructions of software application 307. The actual location of execution of the steps of Fig. 1 is immaterial to the invention. For example, the present invention can be implemented as an automatic reconciliation feature in a personal finance software application, on an investment website, in an accounting application, and the like. In the following discussion, descriptions of the software or function performing particular steps of the invention are intended to refer to steps performed by some computer in accordance with the stored software instructions, or alternatively to refer to any automated scheme or technique for performing a series of steps.

The user initiates a reconciliation mode or feature. Software 307 then downloads or otherwise obtains a bank statement containing a list of transactions. Alternatively, if software 307 is running on bank server 301 the bank statement may already be available to software 307, in which case the user-maintained register is instead uploaded from user's computer 304. The list of transactions from the bank statement may be a subset of all transactions, based on date range, category, and the like. The list is reconciled with a user-maintained register, as follows.

Software 307 matches 102 individual transactions between the downloaded list and a second list derived from the user-maintained register. As described above, this step is performed by, for each transaction in one list, searching for a transaction having identical or similar recorded information in the other list. Once individual transactions have been matched, software 307 determines 103 whether any unmatched transactions remain. If no unmatched transactions remain, matches are output 109 (or marked as reconciled, as appropriate).

If software 307 determines 103 that unmatched transactions remain, it selects 104 an unmatched transaction in one of the transaction lists. The selected transaction is designated as "x" for purposes of the flowchart of Fig. 1, and the transaction list from which the transaction is selected is designated the "first list." (Thus, either the downloaded transaction list or the user-maintained register may be the first list.) The value of transaction x is stored 105 in variable v, and a counter n (representing a date range for determining matches) is initialized at zero. These designations and variable names are arbitrary, and are provided herein for illustrative purposes only.

In one embodiment, software 307 locates additional transactions occurring on the same day (or within a predefined time period) as transaction x, and adds 115 the values of any such transactions to v. Thus, v represents the total value of a number of transactions occurring on the specified day or within the predefined time period of the date of transaction x. In another embodiment, however, each such transaction is handled separately. Step 115 is not necessary to practice the present invention.

Software 307 then generates 106 a list L of unmatched transactions remaining in the second list, that occur within n days of transaction x. List L thus represents a set of candidate transactions that may, in some combination, match transaction x. As n is incremented in later steps (described below), the date range expands so that a larger list L of candidate transactions may be considered. However, the step of successively incrementing n to consider larger date ranges is not necessary to the present invention, and the invention may be practiced with only a single fixed date range, or with no date range at all.

Once value v and list L have been determined, software 307 calls 107 a recursive function (designated "CreateSumList"), using v and L as input to the function. The recursive function, whose operation is described in more detail below, searches list L for a set of transactions having values that, in combination, match value v. If a NULL result is received 108, no match was found. Software 307 then increments 112 the value of n, and determines 113 whether n exceeds a predefined maximum date range. If n does not exceed the date range, steps 106 through 108 are repeated with the new value of n. If n does exceed the date range, no match is found 114 for transaction x, and software 307 returns to step 103 to determine whether any unmatched transactions remain.

In one embodiment, if no unmatched transactions remain in the first list, but unmatched transactions remain in the second list, steps 104 through 108 may be repeated, reversing the designations of first and second list. In other words, if the designation of "first list" and "second list" are first applied to the user-entered register and the downloaded statement, respectively, this designation is reversed when the steps are performed for the second time. In this manner, transaction combinations in both lists can be detected and reconciled.

If in step 108, a result other than NULL is received, the received result is recorded 111 as a match. This received result indicates a set of transactions in the second list that, in combination, match transaction x; i.e., the transactions have values that add up to equal value v. In one embodiment, the set of transactions may equal or approximate value v, in accordance with a "fuzzy" matching scheme. Accordingly, software 307 may indicate that transaction x is reconciled, or matched, with the set of transactions received as a result of the recursive function.

Referring now to Fig. 2, there is shown a flowchart of a recursive function as called in step 107 of the above-described method. The function takes as input a value v of a transaction, and a transaction list L. If no match is found, the function returns a NULL value. If a match is found, the function returns a list containing either a single transaction that matches value v, or two or more transactions that, in combination, match value v.

In one embodiment, the function determines 202 whether list L is too large to be processed, and if so, returns 203 NULL.

The function then determines 204 whether any individual item in list L matches value v, and if so, returns 205 a list containing the matching item. In one embodiment, a "fuzzy" matching method may be employed in connection with step 204, so as to take into account slight differences in values or other transaction information, as is known in the art. In another embodiment, the "fuzzy" matching method is employed only if no matching list is found after the steps of Fig. 2 have been performed.

If, in 204, no item in list L matches value v, the function determines 206 whether list L contains only one item. If so, this item must not match v, and NULL is returned 207.

If, in 206, list L contains more than one item, the function sets 208 an index i to zero. The function then subtracts 209 the value of the i^th^ entry of list L from v, and assigns this value to v′. It makes a copy 210 of list L, omitting the i^th^ entry, and designates this list as L′.

The function then recursively calls itself 211, using v′ and L′ as input. In this way, the function removes one transaction from consideration, and searches for a match between the remaining transactions and a modified value that takes into account the removal of the transaction. If a non-NULL result is received 212, a match has been found between v′ and some combination of transactions in L′. The i^th^ entry, that was previously omitted from L′, is added 213 to the list received from the recursive call. The list, including the added i^th^ entry, is then returned 214.

If a NULL result is received in 212, the function increments 215. If more entries exist 216 in list L, steps 209 through 216 are repeated. If no more entries exist 216, a NULL result is returned 217.

Using a recursive function such as that described in connection with Fig. 2, the present invention successively traverses various combinations of transactions in order to find a match for reconciliation.

In an alternative embodiment, if two or more transactions in one of the lists remain unmatched, the above-described technique is applied to a combination of two or more remaining unmatched transactions. In this way, the invention can detect a match of two or more combined transactions in one list with a different combination of transactions in the other list. For example, a deposit of $20 combined with a deposit of $10 could be matched with two deposits of $15, since each combination yields a total deposit of $30.

From the above description, it will be apparent that the invention disclosed herein provides a novel and advantageous system and method for automated reconciliation between two sets of transaction records. The foregoing discussion discloses and describes merely exemplary methods and embodiments of the present invention. As will be understood by those familiar with the art, the invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. For example, the present invention may be practiced with specific steps and techniques that differ from those depicted in Figs. 1 and 2, such as for example employing a non-recursive function. Alternatively, other architectures and environments, including both networked and non-networked implementations, may be provided. Accordingly, the disclosure of the present invention is intended to be illustrative, but not limiting, of the scope of the invention, which is set forth in the following claims.

What is Claimed is:

1. A computer-implemented method for reconciling a first transaction in a first list with a combination of at least two transactions in a second list, each transaction having a value, the method comprising:

obtaining the first transaction;

obtaining the second list of transactions;

determining whether the value of the first transaction corresponds to a combination of the values of a subset of transactions in the second list; and

responsive to the value corresponding to the combination of values, indicating a match between the first transaction and the subset of transactions.

2. The method of claim 1, wherein each transaction comprises one selected from the group consisting of an investment transaction, a financial transaction, and an accounting transaction.

3. The method of claim 1, wherein determining whether the value of the first transaction corresponds to a combination of the values of a subset of transactions in the second list comprises determining whether the value of the first transaction corresponds to a sum of the values of a subset of transactions in the second list.

4. The method of claim 1, wherein at least one of the steps of obtaining the first transaction and obtaining the second list comprises downloading transactions from a remote server.

5. The method of claim 1, wherein at least one of the steps of obtaining the first list and obtaining the second list comprises retrieving transactions from a storage device.

6. The method of claim 1, further comprising:

determining whether the value of the first transaction corresponds to a value of a transaction in the second list; and

responsive to the value of the first transaction corresponding to the value of a transaction in the second list, indicating a match between the first transaction and the transaction having the corresponding value;

and wherein the step of determining whether the value of the first transaction corresponds to a combination of the values of a subset of transactions in the second list is performed responsive to the value of the first transaction not corresponding to the value of a transaction in the second list.

7. The method of claim 1, wherein each transaction has a date, and wherein obtaining the second list comprises obtaining a list of transactions having dates identical to the date of the first transaction.

8. The method of claim 1, wherein each transaction has a date, and wherein obtaining the second list comprises obtaining a list of transactions having dates within a specified time period of the date of the first transaction.

9. The method of claim 8, further comprising, responsive to the value of the first transaction not corresponding to a combination of the values of a subset of transactions in the second list:

modifying the specified time period; and

repeating the steps of obtaining the second list, determining whether the value of the first transaction corresponds to a combination of the values of a subset of transactions in the second list, and, responsive to the value corresponding to the combination of values, indicating a match between the first transaction and the subset of transactions.

10. The method of claim 1, wherein determining whether the value of the first transaction corresponds to a combination of the values of a subset of transactions in the second list comprises performing a recursive submethod

using a first input parameter including the value of the first transaction and a second input parameter including the set of transactions in the second list.

11. The method of claim 10, wherein performing the recursive submethod comprises:

responsive to one of the values of a transaction in the second input parameter equaling the first input parameter, returning a transaction list including the transaction having the equal value;

responsive to none of the values of transactions in the second input parameter equaling the first input parameter, and the second parameter containing only one transaction, returning an indicator that no match was found;

responsive to none of the values of transactions in the second input parameter equaling the first input parameter, and the second parameter containing more than one transaction, performing the recursive submethod using a modified first input parameter and a modified second input parameter, each modified input parameter omitting a selected transaction.

12. The method of claim 10, wherein performing the recursive submethod comprises:

responsive to one of the values of a transaction in the second input parameter equaling the first input parameter, returning a transaction list including the transaction having the equal value;

responsive to none of the values of transactions in the second input parameter equaling the first input parameter, and the second parameter containing only one transaction, returning an indicator that no match was found;

responsive to none of the values of transactions in the second input parameter equaling the first input parameter, and the second parameter containing more than one transaction, performing the steps of:

a) selecting a transaction in the second input parameter;

b) subtracting the value of the selected transaction from the first input parameter to obtain a modified first input parameter;

c) generating a modified set of transactions including all transactions in the second input parameter except the selected transaction;

d) performing the recursive submethod using a first input parameter including the modified first input parameter and a second input parameter including the modified set of transactions;

e) responsive to the recursive submethod returning a transaction list, adding the selected transaction to the returned list to generate a modified transaction list, and returning the modified transaction list;

f) responsive to the recursive submethod returning an indicator that no match was found, performing the steps of:

responsive to any transactions remaining in the second input parameter, repeating steps a) through f); and

responsive to no transactions remaining in the second input parameter, returning an indicator that no match was found.

13. The method of claim 1, further comprising repeating the obtaining, determining, and indicating steps for a second transaction in the first list.

14. A computer-implemented method for reconciling a first combination of at least two transactions in a first list with a second combination of at least two transactions in a second list, each transaction having a value, the method comprising:

obtaining each transaction in the first combination;

combining the obtained transactions to generate a first value;

obtaining the second list of transactions;

determining whether the first value corresponds to a combination of the values of a subset of transactions in the second list; and

responsive to the first value corresponding to the combination of values, indicating a match between the first combination and the subset of transactions.

15. A computer-implemented method for matching a first value with a combination of at least two values in a list of values, the method comprising:

obtaining the first value;

obtaining the second list of values;

performing a submethod, using a first input parameter including the first value and a second input parameter including the second list of values, to determine whether the first value corresponds to a combination of values from the second list; and

responsive to the first value corresponding to the combination of values, indicating a match for the first value.

16. The method of claim 15, wherein the submethod is recursive, and wherein performing the recursive submethod comprises:

responsive to one of the values in the second input parameter equaling the first input parameter, returning a value list including the equal value;

responsive to none of the values in the second input parameter equaling the first input parameter, and the second parameter containing only one value, returning an indicator that no match was found;

responsive to none of the values in the second input parameter equaling the first input parameter, and the second parameter containing more than one value, performing the recursive submethod using a modified first input parameter and a modified second input parameter, each modified input parameter omitting a selected value.

17. The method of claim 15, wherein the submethod is recursive, and wherein performing the recursive submethod comprises:

responsive to one of the values in the second input parameter equaling the first input parameter, returning a value list including the equal value;

responsive to none of the values in the second input parameter equaling the first input parameter, and the second parameter containing only one value, returning an indicator that no match was found;

responsive to none of the values in the second input parameter equaling the first input parameter, and the second parameter containing more than one value, performing the steps of:

a) selecting a value in the second input parameter;

b) subtracting the selected value from the first input parameter to obtain a modified first input parameter;

c) generating a modified value list including all values in the second input parameter except the selected value;

d) performing the recursive submethod using a first input parameter including the modified first input parameter and a second input parameter including the modified value list;

e) responsive to the recursive submethod returning a value list, adding the selected value to the returned list to generate a modified value list, and returning the modified value list;

f) responsive to the recursive submethod returning an indicator that no match was found, performing the steps of:

responsive to any values remaining in the second input parameter, repeating steps a) through f); and

responsive to no values remaining in the second input parameter, returning an indicator that no match was found.

18. The method of claim 15, wherein each value is associated with a transaction.

19. The method of claim 15, wherein the submethod determines whether the first value corresponds to a combination of values from the second list.

20. A computer-implemented method for matching a first combination of at least two values with a second combination of at least two values in a list of values, the method comprising:

obtaining each value in the first combination;

combining the obtained values to generate a first combined value;

obtaining the second list of values;

performing a recursive submethod, using a first input parameter including the first combined value and a second input parameter including the second list of values, to determine whether the first combined value corresponds to a second combination of values from the second list; and

responsive to the first combined value corresponding to the second combination of values, indicating a match for each value in the first combination.

21. A computer program product comprising a computer-usable medium having computer-readable code embodied therein for reconciling a first transaction in a first list with a combination of at least two transactions in a second list, each transaction having a value, comprising:

computer-readable program code devices configured to cause a computer to obtain the first transaction;

computer-readable program code devices configured to cause a computer to obtain the second list of transactions;

computer-readable program code devices configured to cause a computer to determine whether the value of the first transaction corresponds to a combination of the values of a subset of transactions in the second list; and

computer-readable program code devices configured to cause a computer to, responsive to the value corresponding to the combination of values, indicate a match between the first transaction and the subset of transactions.

22. The computer program product of claim 21, wherein each transaction comprises one selected from the group consisting of an investment transaction, a financial transaction, and an accounting transaction.

23. The computer program product of claim 21, wherein the computer-readable program code devices configured to cause a computer to determine whether the value of the first transaction corresponds to a combination of the values of a subset of transactions in the second list comprise computer-readable program code devices configured to cause a computer to determine whether the value of the first transaction corresponds to a sum of the values of a subset of transactions in the second list.

24. The computer program product of claim 21, wherein at least one of the computer-readable program code devices configured to cause a computer to obtain the first transaction and the computer-readable program code devices configured to cause a computer to obtain the second list comprises computer-readable program code devices configured to cause a computer to download transactions from a remote server.

25. The computer program product of claim 21, wherein at least one of the computer-readable program code devices configured to cause a computer to obtain the first transaction and the computer-readable program code devices

configured to cause a computer to obtain the second list comprises computer-readable program code devices configured to cause a computer to retrieve transactions from a storage device.

26. The computer program product of claim 21, further comprising:

computer-readable program code devices configured to cause a computer to determine whether the value of the first transaction corresponds to a value of a transaction in the second list; and

computer-readable program code devices configured to cause a computer to, responsive to the value of the first transaction corresponding to the value of a transaction in the second list, indicate a match between the first transaction and the transaction having the corresponding value;

and wherein the computer-readable program code devices configured to cause a computer to determine whether the value of the first transaction corresponds to a combination of the values of a subset of transactions in the second list are configured to operate responsive to the value of the first transaction not corresponding to the value of a transaction in the second list.

27. The computer program product of claim 21, wherein each transaction has a date, and wherein the computer-readable program code devices configured to cause a computer to obtain the second list comprise computer-

readable program code devices configured to cause a computer to obtain a list of transactions having dates identical to the date of the first transaction.

28. The computer program product of claim 21, wherein each transaction has a date, and wherein the computer-readable program code devices configured to cause a computer to obtain the second list comprise computer-readable program code devices configured to cause a computer to obtain a list of transactions having dates within a specified time period of the date of the first transaction.

29. The computer program product of claim 28, further comprising computer-readable program code devices configured to cause a computer to, responsive to the value of the first transaction not corresponding to a combination of the values of a subset of transactions in the second list:

modify the specified time period; and

repeat the steps of obtaining the second list, determine whether the value of the first transaction corresponds to a combination of the values of a subset of transactions in the second list, and, responsive to the value corresponding to the combination of values, indicate a match between the first transaction and the subset of transactions.

30. The computer program product of claim 21, wherein the computer-readable program code devices configured to cause a computer to determine whether the value of the first transaction corresponds to a combination of the values of a subset of transactions in the second list comprise computer-readable program code devices configured to cause a computer to perform a recursive submethod using a first input parameter including the value of the first transaction and a second input parameter including the set of transactions in the second list.

31. The computer program product of claim 30, wherein the computer-readable program code devices configured to cause a computer to perform the recursive submethod comprise computer-readable program code devices configured to cause a computer to:

responsive to one of the values of a transaction in the second input parameter equaling the first input parameter, return a transaction list including the transaction having the equal value;

responsive to none of the values of transactions in the second input parameter equaling the first input parameter, and the second parameter containing only one transaction, return an indicator that no match was found;

responsive to none of the values of transactions in the second input parameter equaling the first input parameter, and the second parameter containing more than one transaction, perform the recursive submethod using a modified first input parameter and a modified second input parameter, each modified input parameter omitting a selected transaction.

32. The computer program product of claim 30, wherein the computer-readable program code devices configured to cause a computer to perform the recursive submethod comprise computer-readable program code devices configured to cause a computer to:

responsive to one of the values of a transaction in the second input parameter equaling the first input parameter, return a transaction list including the transaction having the equal value;

responsive to none of the values of transactions in the second input parameter equaling the first input parameter, and the second parameter containing only one transaction, return an indicator that no match was found;

responsive to none of the values of transactions in the second input parameter equaling the first input parameter, and the second parameter containing more than one transaction, perform the steps of:

a) selecting a transaction in the second input parameter;

b) subtracting the value of the selected transaction from the first input parameter to obtain a modified first input parameter;

c) generating a modified set of transactions including all transactions in the second input parameter except the selected transaction;

d) performing the recursive submethod using a first input parameter including the modified first input parameter and a second input parameter including the modified set of transactions;

e) responsive to the recursive submethod returning a transaction list, adding the selected transaction to the returned list to generate a modified transaction list, and returning the modified transaction list;

f) responsive to the recursive submethod returning an indicator that no match was found, performing the steps of:

responsive to any transactions remaining in the second input parameter, repeating steps a) through f); and responsive to no transactions remaining in the second input parameter, returning an indicator that no match was found.

33. A computer program product comprising a computer-usable medium having computer-readable code embodied therein for reconciling a first combination of at least two transactions in a first list with a second combination of at least two transactions in a second list, each transaction having a value, the computer program product comprising:

computer-readable program code devices configured to cause a computer to obtain each transaction in the first combination;

computer-readable program code devices configured to cause a computer to combine the obtained transactions to generate a first value;

computer-readable program code devices configured to cause a computer to obtain the second list of transactions;

computer-readable program code devices configured to cause a computer to determine whether the first value corresponds to a combination of the values of a subset of transactions in the second list; and

computer-readable program code devices configured to cause a computer to, responsive to the first value corresponding to the combination of values, indicate a match between the first combination and the subset of transactions.

34. A computer program product comprising a computer-usable medium having computer-readable code embodied therein for matching a first value with a combination of at least two values in a list of values, the computer program product comprising:

computer-readable program code devices configured to cause a computer to obtain the first value;

computer-readable program code devices configured to cause a computer to obtain the second list of values;

computer-readable program code devices configured to cause a computer to perform a submethod, using a first input parameter including the first value and a second input parameter including the second list of values, to determine whether the first value corresponds to a combination of values from the second list; and

computer-readable program code devices configured to cause a computer to, responsive to the first value corresponding to the combination of values, indicate a match for the first value.

35. The computer program product of claim 34, wherein the submethod is recursive, and wherein the computer-readable program code devices

configured to cause a computer to perform the recursive submethod comprise computer-readable program code devices configured to cause a computer to:

responsive to one of the values in the second input parameter equaling the first input parameter, return a value list including the equal value;

responsive to none of the values in the second input parameter equaling the first input parameter, and the second parameter containing only one value, return an indicator that no match was found;

responsive to none of the values in the second input parameter equaling the first input parameter, and the second parameter containing more than one value, perform the recursive submethod using a modified first input parameter and a modified second input parameter, each modified input parameter omitting a selected value.

36. The computer program product of claim 34, wherein the submethod is recursive, and wherein the computer-readable program code devices configured to cause a computer to perform the recursive submethod comprise computer-readable program code devices configured to cause a computer to:

responsive to one of the values in the second input parameter equaling the first input parameter, return a value list including the equal value;

responsive to none of the values in the second input parameter equaling the first input parameter, and the second parameter containing only one value, return an indicator that no match was found;

responsive to none of the values in the second input parameter equaling the first input parameter, and the second parameter containing more than one value, perform the steps of:

a) selecting a value in the second input parameter;

b) subtracting the selected value from the first input parameter to obtain a modified first input parameter;

c) generating a modified value list including all values in the second input parameter except the selected value;

d) performing the recursive submethod using a first input parameter including the modified first input parameter and a second input parameter including the modified value list;

e) responsive to the recursive submethod returning a value list, adding the selected value to the returned list to generate a modified value list, and returning the modified value list;

f) responsive to the recursive submethod returning an indicator that no match was found, performing the steps of:

responsive to any values remaining in the second input parameter, repeating steps a) through f); and

responsive to no values remaining in the second input parameter, returning an indicator that no match was found.

37. The computer program product of claim 34, wherein each value is associated with a transaction.

38. The computer program product of claim 34, wherein the computer-readable program code devices configured to cause a computer to perform the submethod further comprise computer-readable program code devices configured to cause a computer to determine whether the first value corresponds to a combination of values from the second list.

39. A computer program product comprising a computer-usable medium having computer-readable code embodied therein for matching a first combination of at least two values with a second combination of at least two values in a list of values, the computer program product comprising:

computer-readable program code devices configured to cause a computer to obtain each value in the first combination;

computer-readable program code devices configured to cause a computer to combine the obtained values to generate a first combined value;

computer-readable program code devices configured to cause a computer to obtain the second list of values;

computer-readable program code devices configured to cause a computer to perform a recursive submethod, using a first input parameter including the first combined value and a second input parameter including the second list of values, to determine whether the first combined value corresponds to a second combination of values from the second list; and

computer-readable program code devices configured to cause a computer to, responsive to the first combined value corresponding to the second combination of values, indicate a match for each value in the first combination.

40. A system for reconciling a first transaction in a first list with a combination of at least two transactions in a second list, each transaction having a value, the system comprising:

a first input device, for obtaining the first transaction;

a second input device, for obtaining the second list of transactions;

coupled to the first and second input devices, a memory for storing the first transaction and the second list;

coupled to the memory, a match determination module for determining whether the value of the first transaction corresponds to a combination of the values of a subset of transactions in the second list; and

coupled to the match determination module, a match indication module for, responsive to the value corresponding to the combination of values, indicating a match between the first transaction and the subset of transactions.

41. The system of claim 40, wherein each transaction comprises one selected from the group consisting of an investment transaction, a personal financial transaction, and an accounting transaction.

42. The system of claim 40, wherein the match determination module determines whether the value of the first transaction corresponds to a sum of the values of a subset of transactions in the second list.

43. The system of claim 40, further comprising:

coupled to the memory, a transaction matching device, for determining whether the value of the first transaction corresponds to a value of a transaction in the second list;

wherein the match indication module, responsive to the value of the first transaction corresponding to the value of a transaction in the second list, indicates a match between the first transaction and the transaction having the corresponding value;

and wherein the match determination module determines whether the value of the first transaction corresponds to a combination of the values of a subset of transactions in the second list responsive to the value of the first transaction not corresponding to the value of a transaction in the second list.

44. The system of claim 40, wherein each transaction has a date, and wherein the second input device obtains a list of transactions having dates identical to the date of the first transaction.

45. The system of claim 40, wherein each transaction has a date, and wherein the second input device obtains a list of transactions having dates within a specified time period of the date of the first transaction.

46. The system of claim 40, wherein the match determination module performs a recursive submethod using a first input parameter including the value of the first transaction and a second input parameter including the set of transactions in the second list.

47. The system of claim 46, wherein the recursive submethod comprises:

responsive to one of the values of a transaction in the second input parameter equaling the first input parameter, returning a transaction list including the transaction having the equal value;

responsive to none of the values of transactions in the second input parameter equaling the first input parameter, and the second parameter containing only one transaction, returning an indicator that no match was found;

responsive to none of the values of transactions in the second input parameter equaling the first input parameter, and the second parameter containing more than one transaction, performing the recursive submethod using a modified first input parameter and a modified second input parameter, each modified input parameter omitting a selected transaction.

48. The system of claim 46, wherein the recursive submethod comprises:

responsive to one of the values of a transaction in the second input parameter equaling the first input parameter, returning a transaction list including the transaction having the equal value;

responsive to none of the values of transactions in the second input parameter equaling the first input parameter, and the second parameter containing only one transaction, returning an indicator that no match was found;

responsive to none of the values of transactions in the second input parameter equaling the first input parameter, and the second parameter containing more than one transaction, performing the steps of:

a) selecting a transaction in the second input parameter;

b) subtracting the value of the selected transaction from the first input parameter to obtain a modified first input parameter;

c) generating a modified set of transactions including all transactions in the second input parameter except the selected transaction;

d) performing the recursive submethod using a first input parameter including the modified first input parameter and a second input parameter including the modified set of transactions;

e) responsive to the recursive submethod returning a transaction list, adding the selected transaction to the returned list to generate a modified transaction list, and returning the modified transaction list;

f) responsive to the recursive submethod returning an indicator that no match was found, performing the steps of:

responsive to any transactions remaining in the second input parameter, repeating steps a) through f); and

responsive to no transactions remaining in the second input parameter, returning an indicator that no match was found.

49. A system for reconciling a first combination of at least two transactions in a first list with a second combination of at least two transactions in a second list, each transaction having a value, the system comprising:

a first input device, for obtaining each transaction in the first combination;

coupled to the first input device, a combination module, for combining the obtained transactions to generate a first value;

a second input device, for obtaining the second list of transactions;

coupled to the combination module and the second input devices, a memory for storing the first value and the second list;

coupled to the memory, a match determination module for determining whether the first value corresponds to a combination of the values of a subset of transactions in the second list; and coupled to the match determination module, a match indication module for, responsive to the first value corresponding to the combination of values, indicating a match between the first combination and the subset of transactions.

50. A system for matching a first value with a combination of at least two values in a list of values, the system comprising:

a first input device, for obtaining the first value;

a second input device, for obtaining the second list of values;

coupled to the input devices, a memory for storing the first value and the second list;

coupled to the memory, a recursive function module, for performing a recursive function, using a first input parameter including the first value and a second input parameter including the second list of values, to determine whether the first value corresponds to a combination of values from the second list; and

coupled to the recursive function module, a match indicator for, responsive to the first value corresponding to the combination of values, indicating a match for the first value.

51. The system of claim 50, wherein the recursive function module:

responsive to one of the values of a transaction in the second input parameter equaling the first input parameter, returns a transaction list including the transaction having the equal value;

responsive to none of the values of transactions in the second input parameter equaling the first input parameter, and the second parameter containing only one transaction, returns an indicator that no match was found;

responsive to none of the values of transactions in the second input parameter equaling the first input parameter, and the second parameter containing more than one transaction, performs the recursive submethod using a modified first input parameter and a modified second input parameter, each modified input parameter omitting a selected transaction.

52. The system of claim 50, wherein the recursive function module:

responsive to one of the values in the second input parameter equaling the first input parameter, returns a value list including the equal value;

responsive to none of the values in the second input parameter equaling the first input parameter, and the second parameter containing only one value, returns an indicator that no match was found;

responsive to none of the values in the second input parameter equaling the first input parameter, and the second parameter containing more than one value, performs the steps of:

a) selecting a value in the second input parameter;

b) subtracting the selected value from the first input parameter to obtain a modified first input parameter;

c) generating a modified value list including all values in the second input parameter except the selected value;

d) performing the recursive submethod using a first input parameter including the modified first input parameter and a second input parameter including the modified value list;

e) responsive to the recursive submethod returning a value list, adding the selected value to the returned list to generate a modified value list, and returning the modified value list;

f) responsive to the recursive submethod returning an indicator that no match was found, performing the steps of:

responsive to any values remaining in the second input parameter, repeating steps a) through f); and

responsive to no values remaining in the second input parameter, returning an indicator that no match was found.

53. The system of claim 50, wherein each value is associated with a transaction.

54. A system for matching a first combination of at least two values with a second combination of at least two values in a list of values, the system comprising:

a first input device, for obtaining each value in the first combination;

coupled to the first input device, a combination module, for combining the obtained values to generate a first combined value;

a second input device, for obtaining the second list of values;

coupled to the combination module and the second input devices, a memory for storing the first value and the second list;

coupled to the memory, a recursive function module, for performing a recursive function, using a first input parameter including the first combined value and a second input parameter including the second list of values, to determine whether the first combined value corresponds to a second combination of values from the second list; and coupled to the recursive function module, a match indicator for, responsive to the first combined value corresponding to the second combination of values, indicating a match for each value in the first combination.

RECONCILING COMBINATIONS OF TRANSACTIONS

ABSTRACT OF THE DISCLOSURE

A system, method, and computer program product provide automated reconciliation of transactions. A transaction in a first list is reconciled with a combination of two or more transactions in a second list. A function, which may be implemented as a recursive function, successively searches for combinations of transactions in the second list in order to obtain a match for a transaction in the first list.

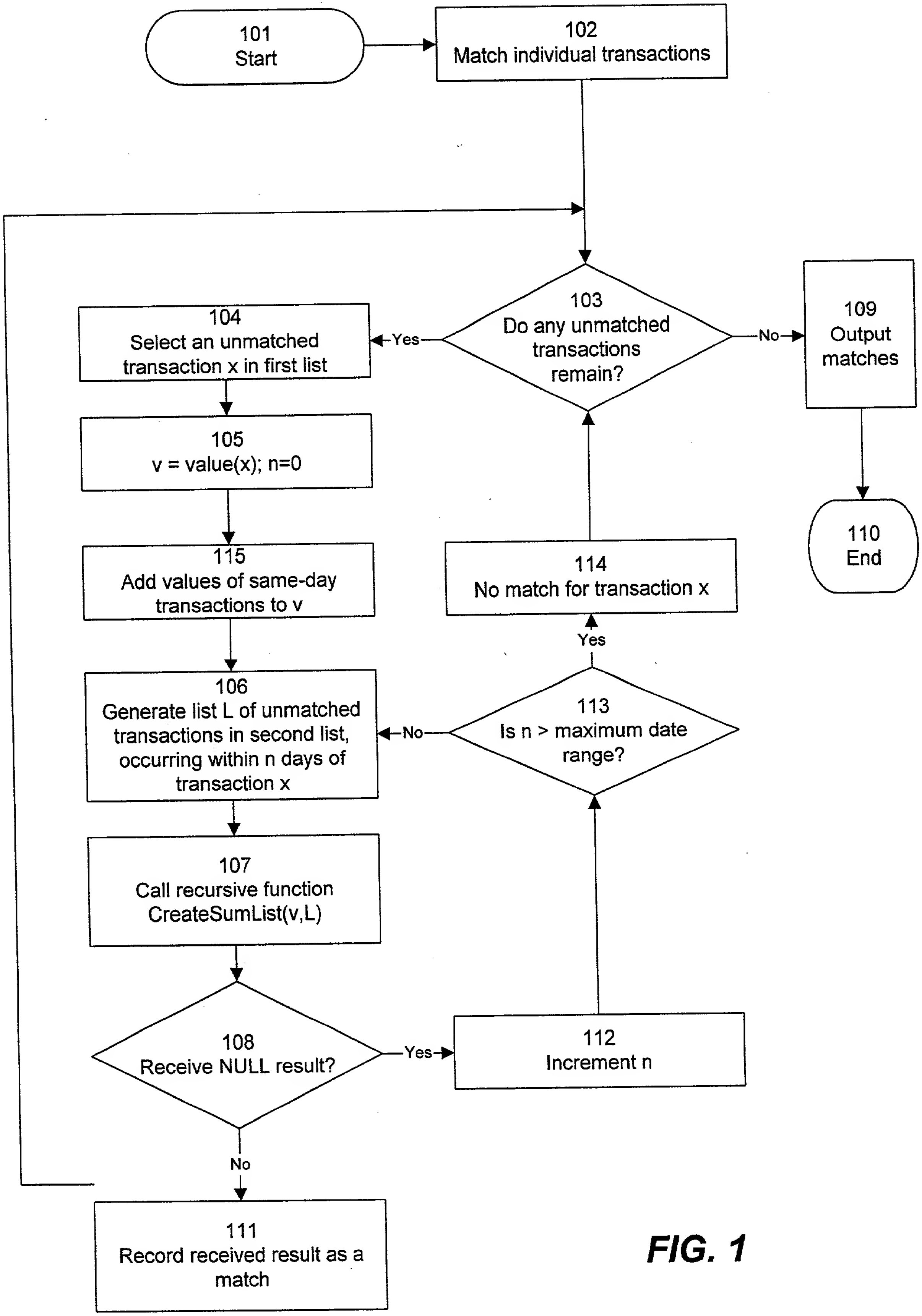

101
Start
102
Match individual transactions
103
Do any unmatched transactions remain?
Yes
No
104
Select an unmatched transaction x in first list
109
Output matches
105
v = value(x); n=0
110
End
115
Add values of same-day transactions to v
114
No match for transaction x
Yes
106
Generate list L of unmatched transactions in second list, occurring within n days of transaction x
No
113
Is n > maximum date range?
107
Call recursive function CreateSumList(v,L)
108
Receive NULL result?
Yes
112
Increment n
No
111
Record received result as a match

FIG. 1

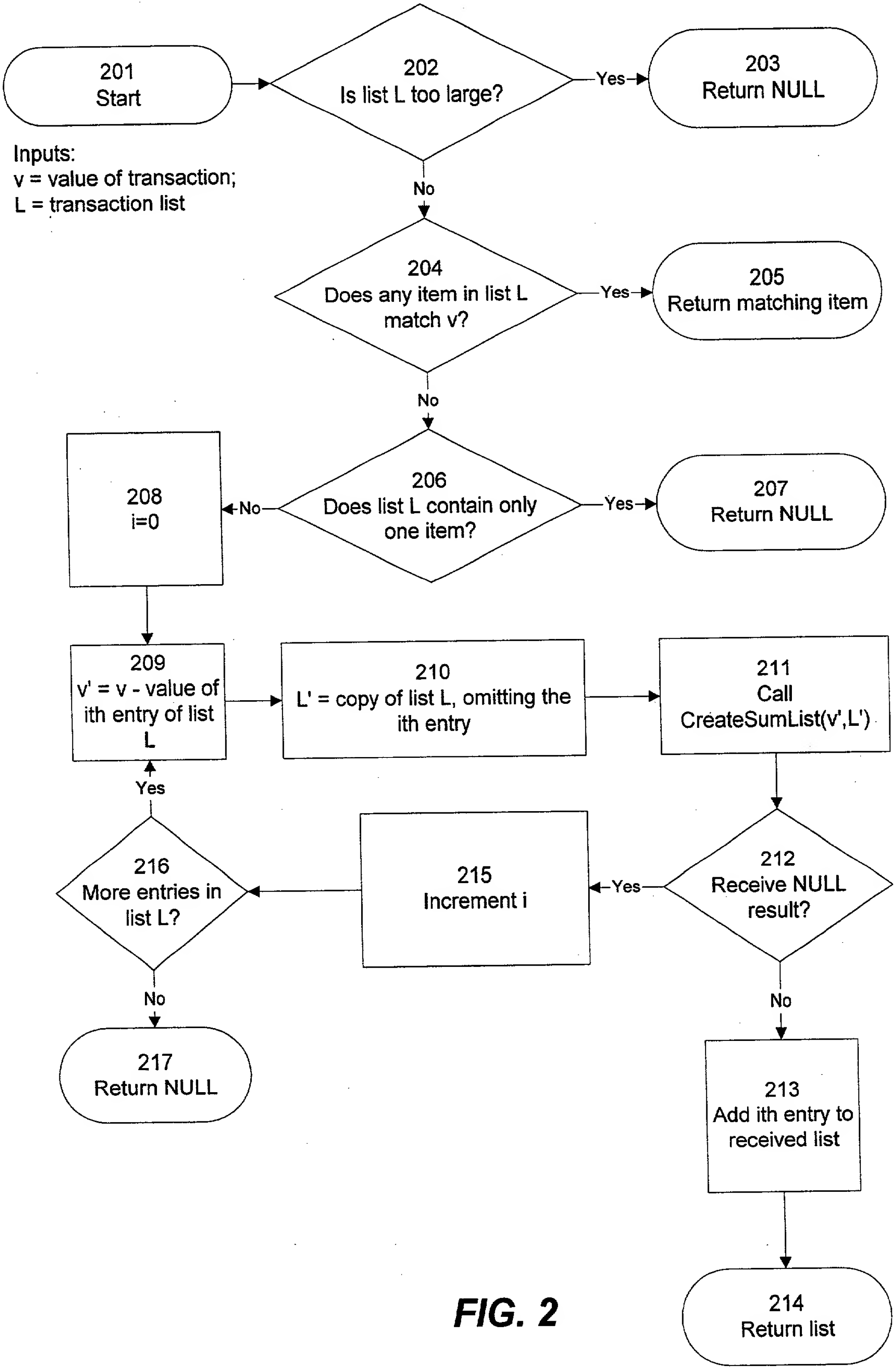

201
Start
Inputs:
v = value of transaction;
L = transaction list
202
Is list L too large?
Yes
203
Return NULL
No
204
Does any item in list L match v?
Yes
205
Return matching item
No
206
Does list L contain only one item?
Yes
207
Return NULL
No
208
i=0
209
v' = v - value of ith entry of list L
210
L' = copy of list L, omitting the ith entry
211
Call CreateSumList(v',L')
212
Receive NULL result?
Yes
215
Increment i
216
More entries in list L?
Yes
No
217
Return NULL
No
213
Add ith entry to received list
214
Return list

FIG. 2

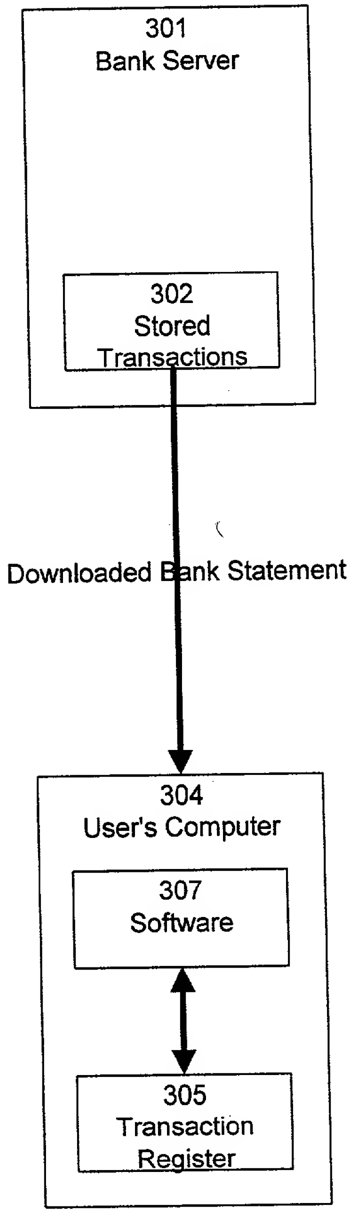

301
Bank Server
302
Stored
Transactions
Downloaded Bank Statement
304
User's Computer
307
Software
305
Transaction
Register

FIG. 3A

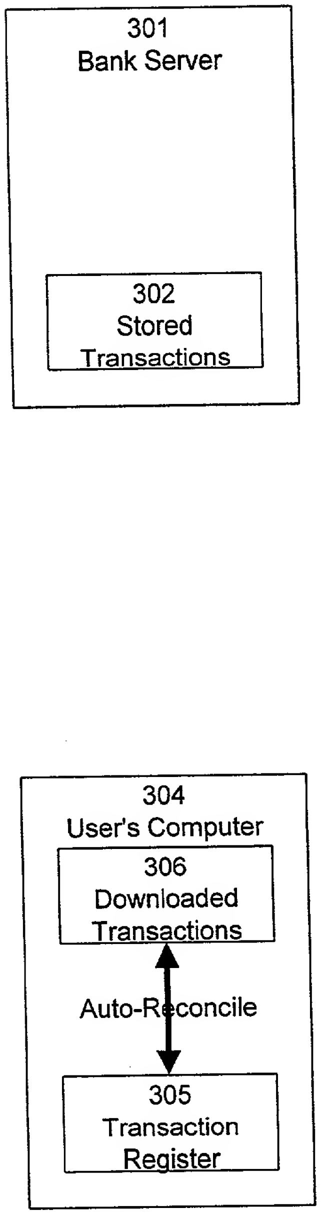
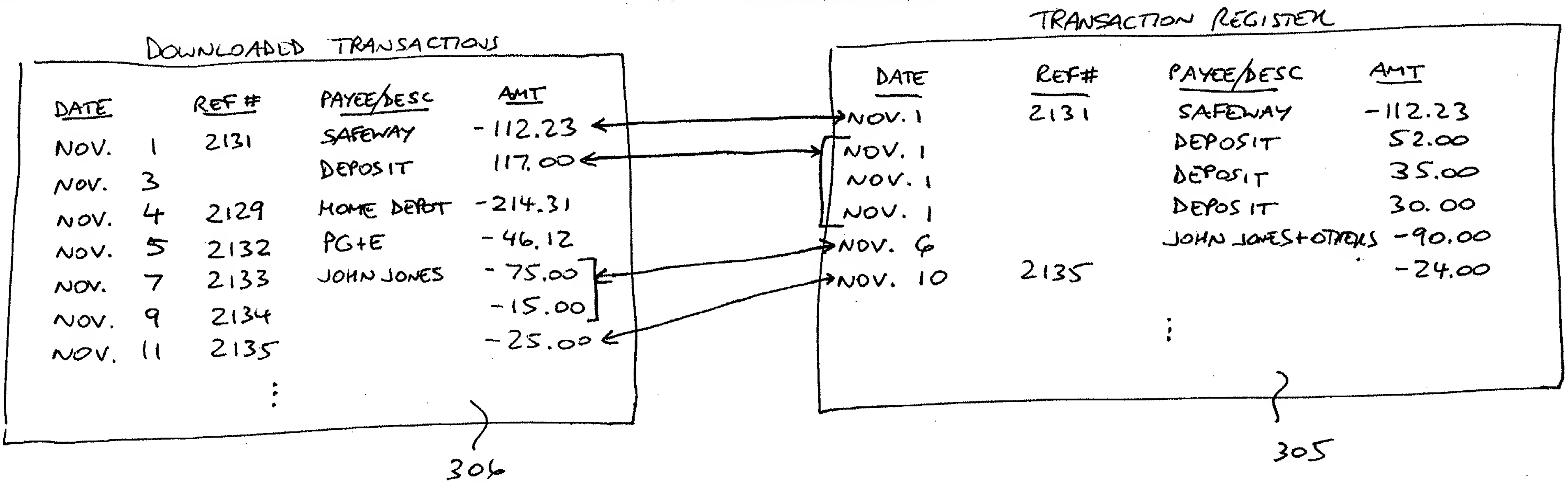

301
Bank Server
302
Stored
Transactions
304
User's Computer
306
Downloaded
Transactions
Auto-Reconcile
305
Transaction
Register

FIG. 3B



DOWNLOADED TRANSACTIONS

DATE	REF #	PAYEE/DESC	AMT
NOV. 1	2131	SAFEWAY	-112.23
NOV. 3		DEPOSIT	117.00
NOV. 4	2129	HOME DEPOT	-214.31
NOV. 5	2132	PG+E	-46.12
NOV. 7	2133	JOHN JONES	-75.00
NOV. 9	2134		-15.00
NOV. 11	2135		-25.00
	⋮		

TRANSACTION REGISTER

DATE	REF#	PAYEE/DESC	AMT
NOV. 1	2131	SAFEWAY	-112.23
NOV. 1		DEPOSIT	52.00
NOV. 1		DEPOSIT	35.00
NOV. 1		DEPOSIT	30.00
NOV. 6		JOHN JONES+OTHERS	-90.00
NOV. 10	2135		-24.00
		⋮	

FIG. 4

PTO/SB/01 (6–95) (modified)
Approved for use through 10/31/96 OMB 0651-0032
Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

0010/PTO
Rev. 6/95

U.S. Department of Commerce
Patent and Trademark Office

DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION

[X] Declaration Submitted with Initial Filing OR [ ] Declaration Submitted after Initial Filing

Attorney Docket Number	**4760**
First Named Inventor	**David R. Larsen**
COMPLETE IF KNOWN	
Application Number	**not yet known**
Filing Date	**not yet known**
Group Art Unit	**not yet known**
Examiner Name	**not yet known**

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

RECONCILING COMBINATIONS OF TRANSACTIONS

the specification of which (*Title of the Invention*)

[X] is attached hereto

OR

[ ] was filed on (MM/DD/YYYY) [________________] as United States Application Number or PCT International Application Number [____________] and was amended on (MM/DD/YYYY) [________________] (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37 Code of Federal Regulations. § 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code § 119 (a)-(d) or § 385(b) of any foreign application(s) for patent or inventor's certificate, or § 365 (a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached? YES	NO
			[ ]	[ ]	[ ]
			[ ]	[ ]	[ ]
			[ ]	[ ]	[ ]
			[ ]	[ ]	[ ]
			[ ]	[ ]	[ ]

[ ] Additional foreign application numbers are listed on a supplemental priority sheet attached hereto:

I hereby claim the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)	
		[ ] Additional provisional application numbers are listed on a supplemental sheet attached hereto.

DECLARATION	**Page 2**

I hereby claim the benefit under Title 35, United States Code § 120 of any United States application(s), or § 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of Title 35, United States Code § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application Number	PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (*if applicable*)

[ ] Additional U.S. or PCT international application numbers are listed on a supplemental priority sheet attached hereto.

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

Name	Registration Number	Name	Registration Number
Amir H. Raubvogel	**37,070**	**Robert R. Sachs**	**42,120**
John R. Carr	**42,390**	**Laura A. Majerus**	**33,417**

[ ] Additional attorney(s) and/or agent(s) named on a supplemental sheet attached hereto.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of Sole or First Inventor:		[ ] A petition has been filed for this unsigned inventor					
Given Name	**David**	Middle Initial	**R.**	Family Name	**Larsen**	Suffix e.g. Jr.	
Inventor's Signature	David R. Larsen			Date	3/22/00		
Residence: City	**San Jose**	State	**CA**	Country	**USA**	Citizenship	**USA**
Mailing Address	**6643 Devonshire Drive**						
Mailing Address							
City	**San Jose**	State	**CA**	Zip	**95129**	Country	**USA**

[ ] Additional inventors are being named on supplemental sheet(s) attached hereto